

PATENT SPECIFICATION

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 (72) Inventor LOUIS MAURY



(54) LURE LAUNCHING CARTRIDGES

(71) WE, SOCIETE E. LACROIX, a Societe a responsabilite limitee organised under the laws of France of Route de Toulouse, 31 Muret — France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention is concerned with arrangements for launching lures and adapted for equipping aircraft to provide the latter with means for confusing and/or deceiving the guiding system of a missile or similar offensive vehicle and machine launched against the aircraft.

In the technique of launching lures, there has, until now been proposed cartridges, whereof the useful load or charge was constituted by one or more projectiles adapted to be ejected simultaneously, on firing, with a view to disposing in the vicinity of the aircraft a certain number of lures proper to permit the former to evade a pursuing missile.

In order to make such cartridges operational, the aircraft is equipped with a launcher in which the cartridges are disposed in parallel side-by-side relationship in a manner which allows them to be fired individually or in a salvo. Such a launcher has the inconveniences of large bulk considering the substantial external surface area of the launcher from which the cartridges emerge, and also its disposition under the aircraft, usually in a place which can often usefully be employed for suspending equipment, such as, bombs or supplementary fuel tanks. Moreover, the ejection of the projectiles can only take place in a direction substantially perpendicular to the axis of the aircraft, a direction of ejection which can be unfavourable since the lures have a tendency to leave too rapidly the field of detection of the guiding system of the missile.

The present invention has for its object a launching cartridge adapted to be made operational by a launcher which does not

have the aforesaid inconveniences of prior art launchers of the same capacity.

According to the invention there is provided a cartridge for launching lures, comprising a casing closed at one of its ends, a plurality of projectiles disposed one behind the other within the casing and each provided with a charge adapted to form at least one lure, a plurality of ejection and delay firing arrangements, each of which is operatively associated with one of the projectiles for successively ejecting same from the casing and firing the charge, and an electrical control means for controlling in sequence the ejection and delay firing arrangements, each of the latter comprising an electrically controllable pyrotechnical ejection means for ejecting the projectile, pyrotechnical firing means for the charge of the projectile, and pyrotechnical delay means disposed between the ejection means and the firing means whereby on activation of each firing arrangement by the control means the associated projectile is ejected from the casing before the charge is fired.

With such "sequential" arrangement of the elementary projectiles, it will be manifest that the cross-section of the cartridge can be practically the same as that of a prior art cartridge equipped with a single projectile. It is to be understood that the length of the cartridge of the invention is several times greater than that of the prior art cartridge. Nonetheless, such an increase in the longitudinal dimension, considering the cartridge orientated along the axis of displacement of the aircraft, modifies only a little its flight path when the capacity of the cartridge is multiplied by the number of elementary projectiles contained thereby. The orientation along the axis of the aircraft is of further advantage in that it improves the efficiency of the ejected lures which thus form a screen in front of or behind the aircraft and which free the lower surface of the latter to which can then be suspended other desired equipment.

According to a preferred arrangement the charge of the projectile is constituted by a

- pyrotechnic composition which burns in the infra-red part of the spectrum and is preferably enclosed in a tube which is closed at its ends by two stationary plugs tied together by a connection of limited resistance adapted to be broken under on activation of a further charge provided in the tube for ejecting the plugs and firing the pyrotechnic composition.
- 5 An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:—
- 10 Figure 1 is a fragmentary axial sectional view of a cartridge for launching lures according to the invention;
- 15 Figure 2 is a part-sectional fragmentary elevation of the cartridge of Figure 1;
- 20 Figure 3 is a sectional view on the line III—III of Figure 2;
- 25 Figure 4 is a fragmentary sectional view on the line IV—IV of Figure 2;
- 30 Figure 5 is a sectional view of a preferred embodiment of elementary projectile for the cartridge according to Figure 1;
- 35 Figure 6 is a schematic view partly broken away of a launcher adapted to use the cartridge of the invention;
- 40 Figure 7 is a rear view of the element of equipment shown in Figure 6; and,
- 45 Figure 8 is a diagram illustrating an automatic control circuit for successively firing the ejection charges of the different projectiles of a cartridge according to the invention.
- 50 In Figures 1 to 4, reference 10 indicates a cartridge adapted to be fired from an aircraft with a view to launching a number of lures, such for example as bundles of electro-magnetic lures, or elements which burn in the infra-red range of the spectrum to confuse and/or deceive the guiding system of a missile or similar offensive vehicle or machine launched against the aircraft.
- 55 In known manner, the cartridge comprises a tubular casing 12 open at its front end and closed at its rear end 16 by a cap 14 which is fixed to the casing 12 by crimping with the inter-position of an annular fluid-tight seal 18.
- 60 According to the invention, the casing 12 encloses a plurality of elementary projectiles indicated at 20, which projectiles are disposed one behind the other in the casing 12. In the following description it will be assumed that the elementary projectiles are identical to each other insofar as their form and content is concerned. It will be understood, however, that these projectiles 20 may be different (notably as regards their axial dimensions, operation and/or content).
- 65 Each elementary projectile 20 is provided with a lightweight alloy casing 22 closed at its front end 24 and provided at its rear end 26 with an ejection and delayed firing arrangement indicated generally by the reference 28. Each casing 22 encloses a pre-determined useful load or charge 30 adapted when put into operation, as explained hereafter, to constitute at least one lure for the missile or vehicle launched against the aircraft. In the present case, the useful loads or charges 30 are constituted by a pyrotechnic composition adapted, when burning, to provide an infra-red radiating source. This composition is either, in the known form, of a wafer, or preferably in the form of a plurality of independent annular pellets or discs 32 adapted to be ejected from the casing 22 which contains them and ignited so as to burn in the manner of a star.
- 80 It is to be understood that the constitution, in the form of a pyrotechnic composition in the infra-red range of the spectrum, of the useful load or charge 30 is given only by way of example. This useful load or charge can be varied and may be for example, one or more bundles of small metallised needles each constituting a dipole adapted to form a lure for the electromagnetic guidance system of the vehicle or missile.
- 85 The ejection and delayed firing arrangement 28 is disposed in a body 36 which is fixed by means of shear pins 34 with the interposition of fluid-tight seal 36 to the rear part 26 of each of the casings 22, this arrangement 28 comprising essentially an ejecting pyrotechnic or explosive charge 38 conveniently fixed to the rear of the body 36 of the arrangement 28, at least one electric igniter 40 (see Figure 4) embedded in the charge 38, a pyrotechnic trajectory delay 42 constituted, for example, by two pyrotechnic delay cords 44 functioning in parallel, a firing transmission relay 46, a security plug 48, and an igniting pyrotechnic charge 50 disposed in a recess of the body 36. A grill 54 conveniently fixed, by crimping, for example, to the body 36, maintains the charge 50 in the interior of the recess 52.
- 90 The security plug 48 comprises a body 56 mounted to slide in a slideway 58 conveniently fixed in the body 36 through the intermediary of screws such as 60. As shown particularly with reference to Figures 2 and 3 the body 56 comprises a bolt 62 which is radially urged, towards an opening 63 in the body 36 to abut on the internal skin of the casing 12, through the intermediary of one or more springs such as 64 compressed in a bore 66 of the body 56 and disposed between the bottom of this bore and a bolt 68 slidably mounted in the latter. The body 56 comprises a central opening 70 which in the normal security position of the body 56 is located outside the path between the relay
- 95 100 105 110 115 120 125 130

46 and the thin bottom of the recess 52.

On ejection of the casing 22 the body 56 is urged radially towards the exterior by the springs 64 so that its orifice 70 is in register with the relay 46 which permits the latter to ignite the composition 50 with a view to putting into operation the useful load or charge 30 contained in the interior of the casing 22. Thus, the ignition of the charge 50 by the relay 46, once the body 56 is displaced to its position of alignment therewith, can only occur at the end of the combustion of the cords 44. By way of example, the ignition delay introduced by these cords is between .05 and .1 of a second.

It will be observed that each casing 22 is maintained either at the following casing 22 or at the bottom of the cartridge cage 14 through the intermediary of pins 72 which are adapted to be sheared when the ejecting charge 38 corresponding to the casing in question is fired. This firing, as explained above, is controlled by the electric igniter 40, whereof the two leads 74 and 76 (see Figure 4) are connected to a flexible printed circuit 78 conveniently disposed between the casing 12 and the corresponding elementary projectile 20.

In the embodiment shown the different conductors (or the conductive leaves) of the printed circuit 78 are connected to a junction box 80 fixed with interposition of fluid-tight seal 82 in an opening 84 provided in the bottom of the cap 14. Moreover, the different contacts A, B, C and D of the box 80 are connected to the different leaves of the printed circuit 78 in such a manner as to permit successive firing of the igniters 40 which are located in the rear part of the different elementary projectiles 20 disposed in the cartridge 10. The junction box is, at its entry side, connected to a central exterior control (not shown) adapted to send successively electric pulses which effect the successive actuations of the arrangements 28.

In a modification (not shown) the different conductors of the circuit 78 are connected to control outlets corresponding to an automatic triggering circuit disposed in the bottom of the cartridge 10 and adapted to command successively and automatically the firing of the arrangements 28 on reception of a simple electric voltage signal from the exterior. A possible arrangement of such a triggering circuit will be described later with reference to Figure 8.

The maintenance in the casing 12 of the assembly of projectiles 20 is assured by lightly crimping the front exterior 86 of the casing 12 on the base of the casing 22 of the first elementary projectile 20 disposed in this casing with the interposition ad-

vantageously of an annular fluid-tight seal 88.

The functioning of the launching cartridge described above is as follows:—

Through the intermediary of an electric control circuit (not shown) conveniently connected to the conductors of the circuit 78 one proceeds to fire the electric igniters 40 of the arrangement 28 corresponding to the first elementary projectile 20 disposed in the region of the end 86 of the casing 12. The igniter 40 fires the corresponding ejection charge 38 which causes ejection of the elementary projectile 20 out of the cylindrical casing 12 forming the launching tube. The ejecting charge 38 simultaneously ignites the two pyrotechnic cords 44 of the delay arrangement 42 and the body 56 is displaced radially towards the exterior under the action of the springs 64 on ejection of the casing 22 outside the casing 12; on completion of combustion of the cords 44 the relay 46 in its turn ignites the charge 50. Indeed, the opening 70 of the body 56 is then in alignment with the relay 46 and the thin bottom of the recess 58. By burning, the charge 50 initiates the inflammation of the different parcels of pyrotechnic composition 32 contained in the casing 22 and thus causes them to be ejected from the casing 22.

In the aforementioned modification, according to which the load or charge 30 would be constituted by one or more packets of small metallised needles, each constituting an electro-magnetic lure (dipole), the igniting charge 50 would be used to cause the expulsion from the casing 22 of the different packets of metallised needles which constitute its load.

In the preferred embodiment shown in Figure 5 of an elementary projectile 20 the casing is constituted by a cylindrical tube 22a whereof the front and rear ends are closed in airtight fashion by two stationary plugs 24a and 36a respectively. The rear plug 36a houses an ejection and firing arrangement 28a similar to the arrangement 28 described above (electric igniter 40, ejection charge 38, pyrotechnic delay 42, relay 46, security plug 48, ignition charge 50 maintained by a grill or similar 54). The front plug 24a itself also encloses an auxiliary firing charge 51 conveniently maintained in a recess 53 of the plug by a grill 5.

The plugs 24a and 36a are tied together by a connection of limited resistance 57 adapted to be broken when the charges 50 and 51 are fired. This connection 57 can be constituted, as shown, by two rods 59 and 61 conveniently fixed respectively to the grill 54 of plug 36a and to the assembly of the plug 24a, the rods being connected to each other by a shear pin 63.

The tube 22a houses a charge of pyrotechnic composition 30a which burns in the infra-red range of the spectrum. This charge can be either in the form of a homogeneous mass of generally annular form, the cross-section of the internal passage whereof is preferably in the form of a star with a view to controlling the combustion of the mass, or, as shown, in the form of a plurality of independent juxtaposed annular pellets 32a. In this latter case, it is desirable to provide an empty space 65 at the centre of the tube 22a with the aid of an annular distance piece 67, for example. Thus, after ejection of the plugs 24a and 36a resulting from the firing of the charges 50 and 51 the pellets 32a will be ejected from each end of the tube 22a under the action of the pressure developed by their combustion gases in the space 65.

With the described arrangement, it will be understood that with the aid of a single cylindrical casing 12 it is possible to proceed with the launching of two, three or more elementary projectiles by controlling by electric means the successive firing of the different electric igniters 40 which are provided. The security plug 48 which is provided for each of the projectiles prevents untimely firing of the pyrotechnic composition constituting the load or charge 30 and also during the time that the projectile to be ejected is in the interior of the casing 12.

The successive disposition of the different elementary projectiles 20 of the cartridge 10 limits, as will easily be understood the surface required for their ejection only to the cross-sectional area of the casing 12.

A particular benefit of this disposition is seen by considering the element of equipment 90 which is shown in Figures 6 and 7 of the drawing.

This element of equipment 90 can be constituted by a fuel reservoir or even by a suspension arrangement adapted to be fixed under the aircraft with a view to suspending from the latter a certain number of bombs.

The essential characteristic, within the scope of the present invention, of the element of equipment 90 which can thus be of any known convenient type is that its rear part 92 is hollow and provides a base support 94 adapted to receive a plurality of cartridges such as those described above under the reference 10.

The rear part 92 is provided with an opening 96 which is adapted to permit ejection of different elementary projectiles 20 contained in the cartridges 10 disposed on the base support 94. In the embodiment shown, the base support is of generally planar form and the cartridges 10 are

disposed alongside one another in parallel disposition.

The casings 12 of the cartridges 10 can be interconnected to each other in a manner to constitute a compact cellular structure whereof the different cells will be of cylindrical form (with a round or octagonal base for example) and each of which contains a number of elementary projectiles such as those defined above with reference 20.

It is in this use (grouped disposition at the rear part of an element of equipment) that the cartridge of the invention presents all its advantages. Indeed any element of equipment such as 90 must present a rear part profiled in a manner not to cause significant agitations in the flow of air along this element, on the one hand, and not to limit simultaneously, on the other hand, the flight movement. The profiled form of this rear part 92 thus permits the use of cartridges 10 which may be of substantial length and thus have significant capacity insofar as is concerned with the number of elementary projectile 20 which are adapted to be disposed therein.

Thus, the ejection towards the rear of the aircraft, thanks to this orientation of cartridges 10, permits the conferring on the individual ejected lures by the latter of an optimum yield and efficiency by remaining in the field of detection of the guiding system of the missile launched against the aircraft.

It will be understood that each cartridge 10 can also be used directly by being conveniently fixed with appropriate orientation to a fixed part of the aircraft, the firing control being effected thanks to an electric connection between the junction box 80 and the central firing position.

In this last variation of use, it is advantageous that the firing of the charges 38 be effected automatically by a triggering circuit housed in the cartridge itself and actuated by the simple application of an electric voltage as has already been suggested above. An example of such a circuit is shown in Figure 8.

In Figure 8 the references 100 and 102 designate respectively the feed line adapted to be connected to the 27 volts continuous positive voltage source of the aircraft through the intermediary of a control contact and the connection to earth of the triggering circuit.

Closure of contact 104 causes firing of the electric igniters 40a of the firing and ejection arrangement 28 corresponding to the first elementary projectile to be ejected from the casing 12. Closure of contact 104 equally causes charging of a 670 μ F condenser 106 and the appearance at the

junction 108 which is connected to the line 100 by a 100 kilo ohms resistance 110 of a voltage that a zener diode 112 stabilises at 15 volts. Two RC circuits 114—116 and 118—120 with controllable time constants respectively control the gates 122 and 124 of two field effect transistors 126 and 128 whereof the "drain" electrodes are directly connected to the line 100 and the "source" electrodes to the line 102 by 48 kilo ohm polarising resistances 130. Each of the transistors 126 and 128 excite across a zener diode 132 (or 134) controlled to 5 volts, the gate 136 (or 138) of a thyristor 140 (or 142) disposed between the feed line 100 and the pair of electric igniters 40b (or 40c) which it acts to fire.

The RC circuits 114—116 and 118—120 are controlled so as to trigger the firing of igniters 40b and 40c with a certain time difference (from .2 to 2 seconds for example) for reasons evident for good functioning. The 670 μ F condenser serves to furnish significant energy when firing charges 40b and 40c.

The triggering circuit described above can be contained in a block moulded in the form of a disc that can be disposed in the cap 14 of a cartridge 10. It only then remains to provide across this bottom an electric contact with a view to feeding the voltage of the line 100 when necessary.

WHAT WE CLAIM IS:—

1. A cartridge for launching lures, comprising a casing closed at one of its ends, a plurality of projectiles disposed one behind the other within the casing and each provided with a charge adapted to form at least one lure, a plurality of ejection and delay firing arrangements, each of which is operatively associated with one of the projectiles for successively ejecting same from the casing and firing the charge, and an electrical control means for controlling in sequence the ejection and delay firing arrangements, each of the latter comprising an electrically controllable pyrotechnical ejection means for ejecting the projectile, pyrotechnical firing means for the charge of the projectile, and pyrotechnical delay means disposed between the ejection means and the firing means whereby on activation of each firing arrangement by the control the associated projectile is ejected from the casing before the charge is fired.

2. A cartridge according to Claim 1, in

which a flexible printed circuit is disposed between the casing and each projectile to transmit electrical signals from the electrical control means to the ejection and delay firing arrangement associated with said projectile.

3. A cartridge according to claim 1 or 2, in which each ejection and delay firing arrangement further comprises a security plug adapted to prevent the transmission of a firing signal between the ejection means and the firing means for as long as the corresponding projectile remains in the interior of the casing.

4. A cartridge according to any one of claims 1 to 3 in which the charge of at least one of the projectiles is constituted by a pyrotechnic composition adapted to burn as a radiating source in the infra-red range of the spectrum.

5. A cartridge according to claim 4, in which the pyrotechnic composition charge is enclosed in a tube closed at its ends by two stationary plugs tied together by a connection of limited resistance adapted to be broken on the activation of a further charge disposed in the tube for ejection of the plugs and ignition of the pyrotechnic composition.

6. A cartridge according to claim 5, in which the pyrotechnic composition charge is constituted by a plurality of juxtaposed independent annular pellets adapted to be ignited and ejected from the tube when the projectile is fired, an empty space being provided in the middle of the tube so that the ejections can take place at each end of the latter.

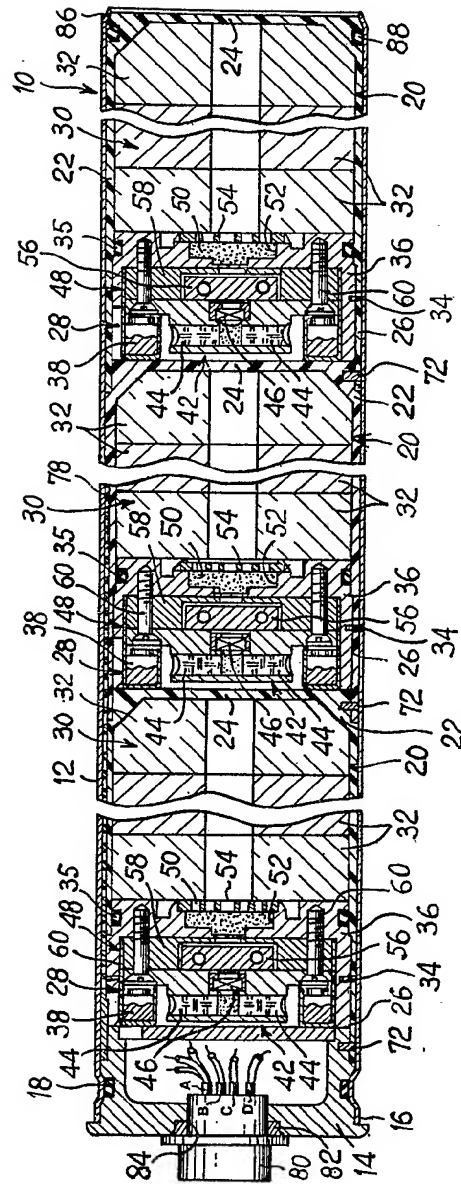
7. A cartridge according to any one of claims 1 to 6, in which the electrical control means is disposed at the closed end of the casing and comprises an electrical triggering circuit adapted on reception of a voltage signal to control successive firing of the ejection and delayed firing arrangements of the elementary projectiles of the cartridge.

8. A cartridge according to any preceding claim, in which the casing is cylindrical with its end closed by a cap.

9. A cartridge for launching lures, substantially as hereinbefore described with reference to Figs. 1 to 5 and 8 of the accompanying drawings.

MARKS & CLERK,
Chartered Patent Agents,
Agents for the Applicants.

Fig. 1



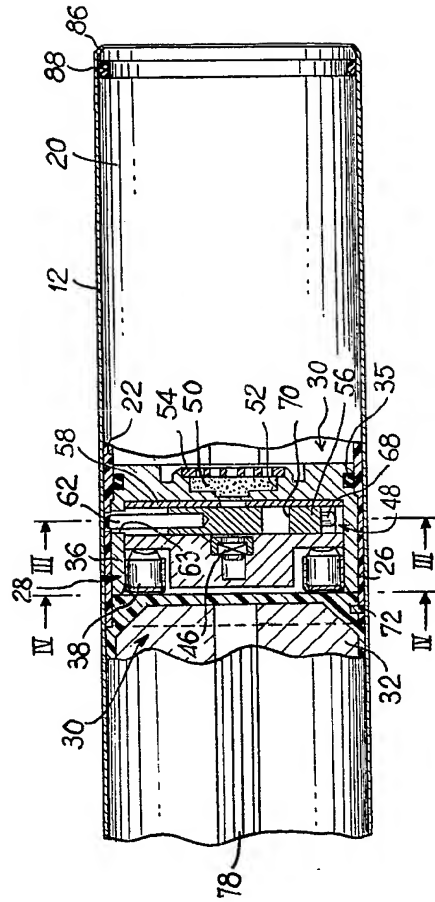


FIG. 2

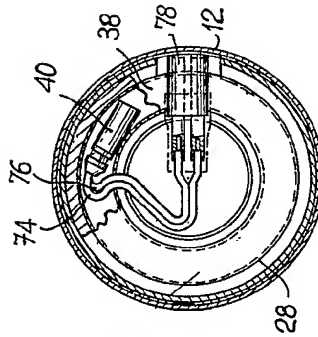


FIG. 4

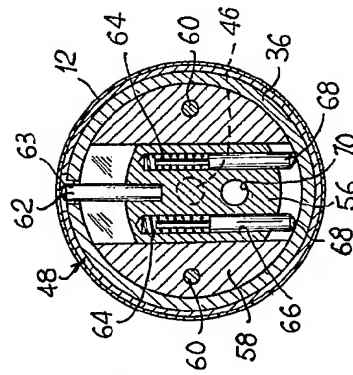


FIG. 3

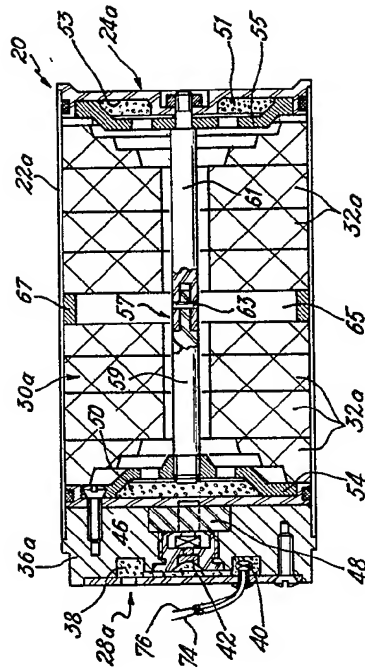


FIG. 5

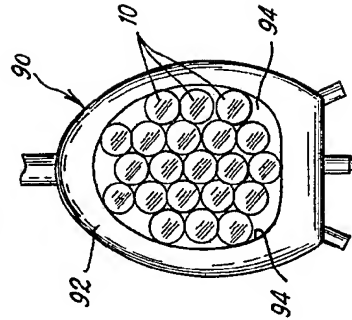


FIG. 7

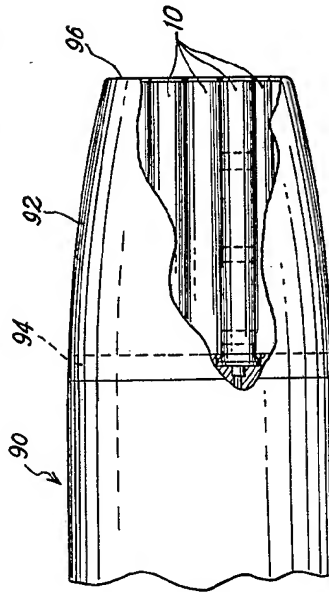


FIG. 6

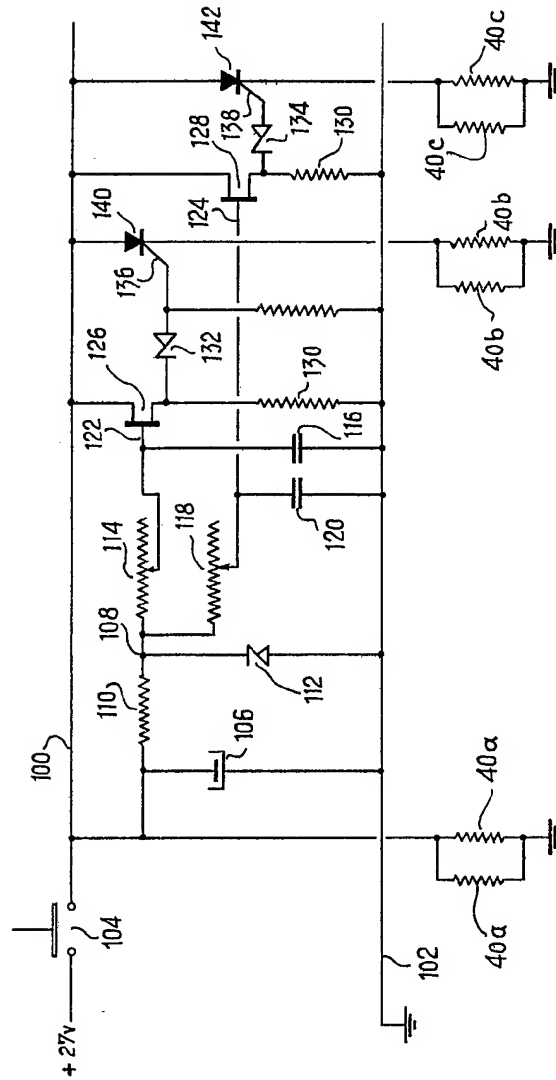


Fig. 8